

July 9, 2015

Mark Levin
President/CEO
Mining & Environmental Services LLC
PO Box 1511
Idaho Springs, CO 80452

Subject: Red and Bonita Mine, Silverton, CO
Site Visit Summary and Ground Control Plan

Mr. Levin:

On June 25th, 2015, L-7 Services LLC (L-7) viewed the mill level tunnel workings associated with the upcoming Red and Bonita Mine Bulkhead Project at the Red and Bonita Mine near Silverton, Colorado. The underground visit was headed by Allen Sorensen (DRMS) with Will Beech (MES) also attending; approximately one hour and 15 minutes were spent underground. The primary focus of the site visit was to assess rock conditions and rock support requirements associated with the bulkhead project. The Red and Bonita Mine consists of a main adit with several side drifts. The work will primarily be within the main adit drift (main crosscut heading) extending from the portal to the bulkhead location approximately 275 feet inby. An existing belled out section of the adit was selected by DRMS for the bulkhead location with four drill holes evident in the ribs for probe and packer testing. The adit areas at the bulkhead and outby will involve the greatest amount of construction activity associated with mucking out the invert sludge, construction of the bulkhead, and installation of permanent piping. Beyond the bulkhead location, the 275-drift meets the main crosscut heading; work in the 275-drift will be limited to mucking out the invert sludge and installation of a cofferdam and bypass pipe to facilitate bulkhead construction. Similarly, beyond the bulkhead location on the main drift, work will be limited to mucking out the invert to Sta. 3+00 and construction of another cofferdam and bypass pipe for bulkhead construction. At Sta. 3+62, the main adit branches off to the north (north heading) which veers to the east and extends several hundred feet inby. As described by DRMS during the site visit, the furthest inby terminus of the bulkhead project is near the junction of the 764 drift (from the north) with the northern heading (near Sta. 7+64) where a ¾" or 1" injection pipe will terminate. Work on the northern heading will be limited to installing the injection pipe in the invert with the inby termination of the injection pipe raised on the south rib above the invert sludge; no mucking is anticipated for the northern heading.

The typical drift dimensions are roughly 5 feet wide by 7 feet high with either a rectangular or horseshoe shaped geometry depending on the rock bedding. Extensive sludge (2'-3+' high) is present in the invert and prior DRMS inspections have created a central slot in the sludge. Travel during the site visit remained as much as practical within the existing slot to avoid loosening and discharging additional sludge from the portal. Water flows continuously in the invert (primarily within the central slot) and was estimated by others to be around 400 to 600 gpm during the inspection. Prior DRMS inspections have estimated the water flow to be approximately 300 gpm. The water inflow was observed to be primarily from the existing drifts (275 drift; 764 drift; and a large amount from the northern drift beyond the 764 drift) with limited groundwater seepage observed along the back and ribs of the mine drifts accessed during the site visit.



The work areas visited are marked on the DRMS map of underground workings of the Red and Bonita Mine below:

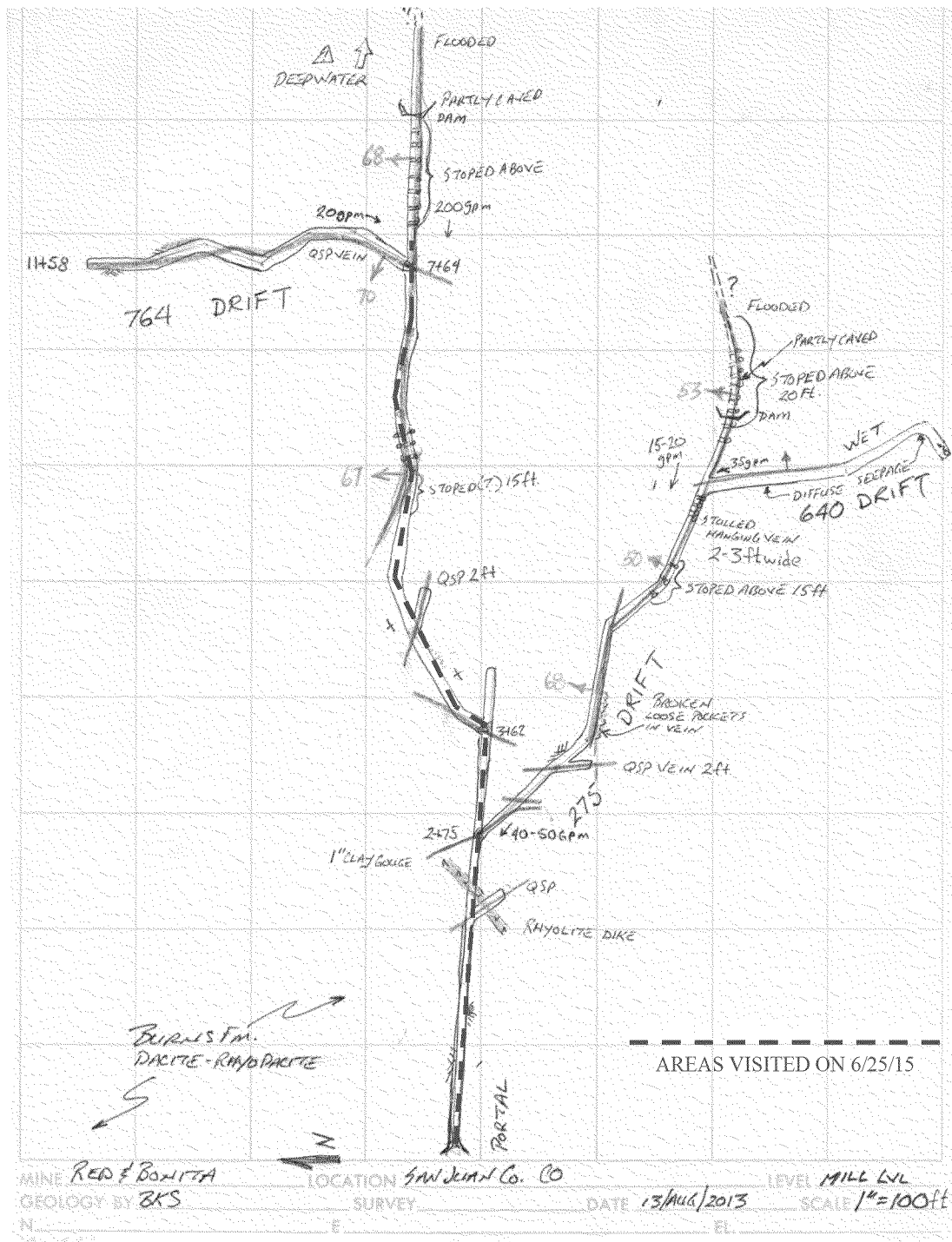


Figure 1: Detailed Map of Underground Workings
(modified from DRMS Red and Bonita Mill Level Survey Map; 2013)



The majority of the mine drifts viewed are currently unsupported with only two limited areas supported by timber: a single stull with overhead lagging exists at the junction of the main adit drift with the northern heading and a more extensive zone of stulls, rib sets, and lagging exists on the northern drift. The host rock consists of the Burns Formation of the Silverton Volcanic Group per the USGS *Geology of the Ironton Quadrangle* (1964):

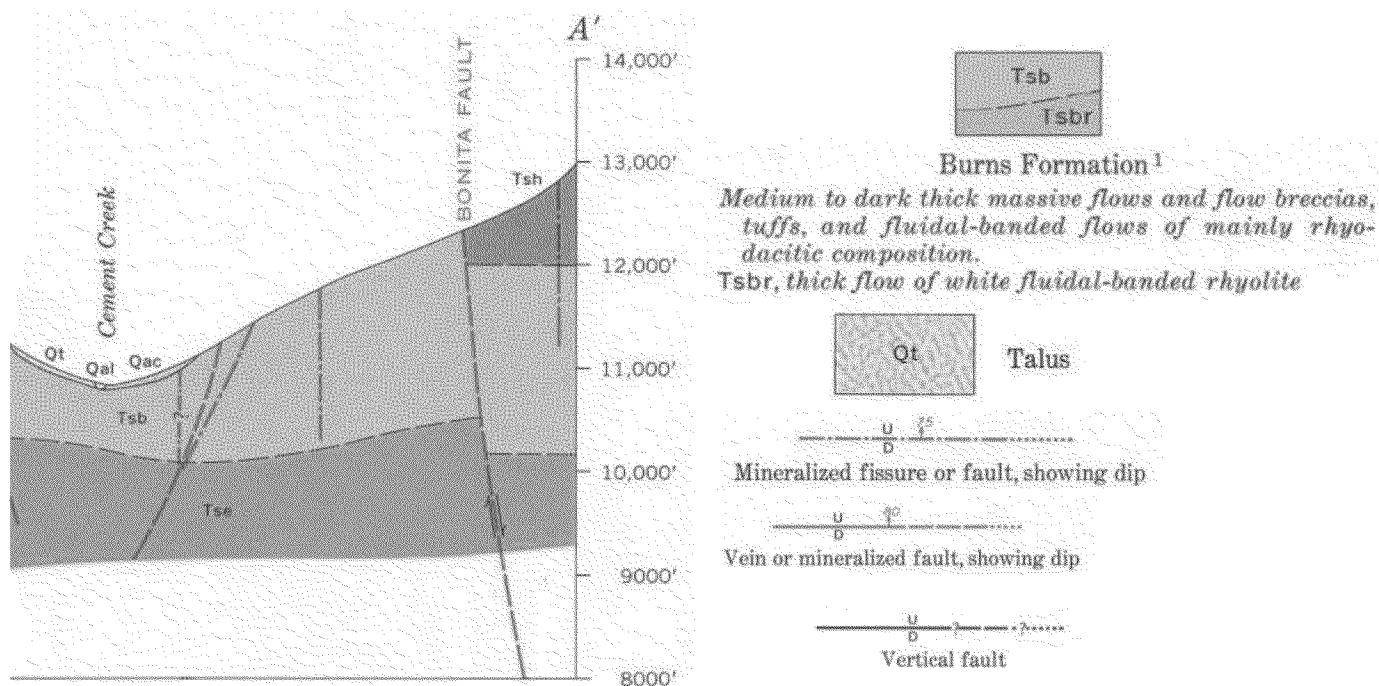
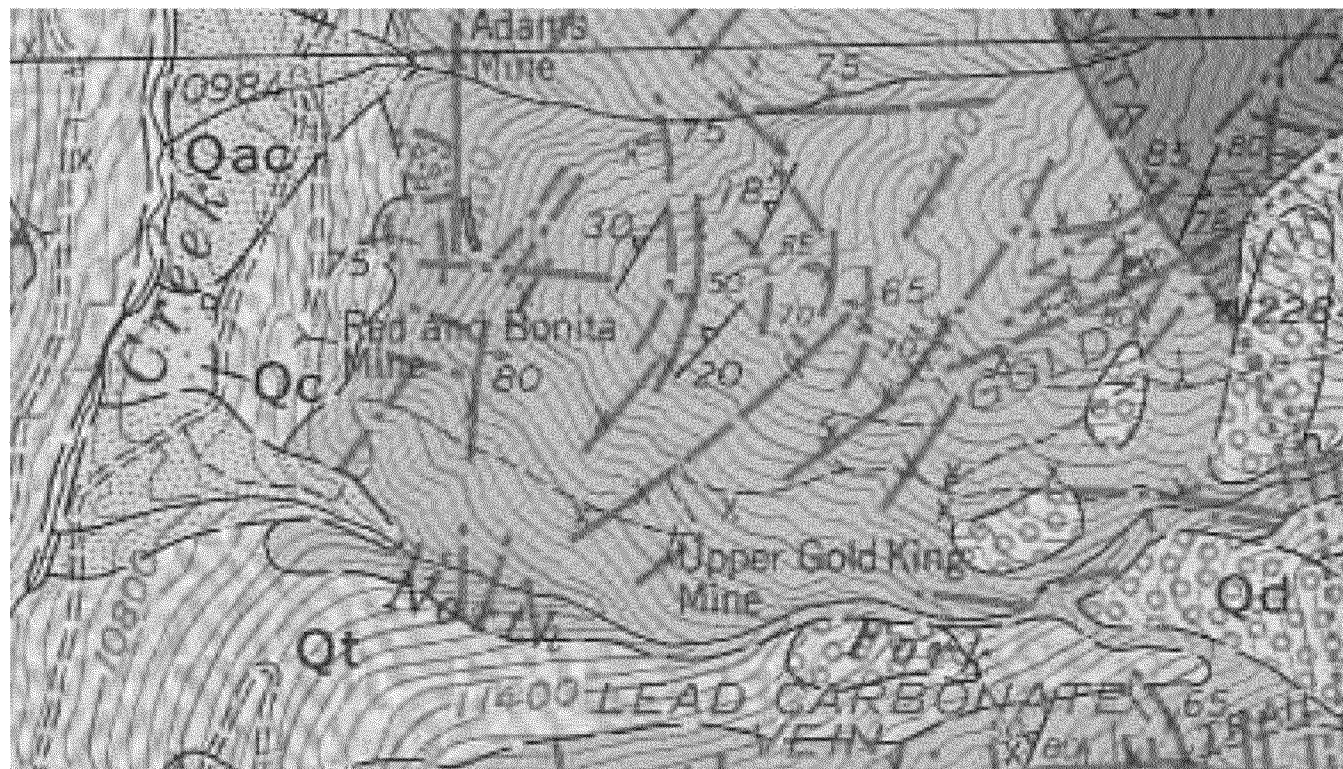
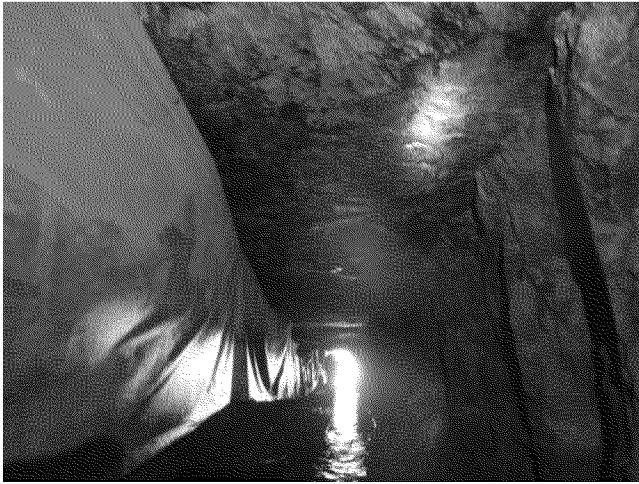


Figure 2: Geology and Rock Description (per USGS *Geology of the Ironton Quadrangle* (Burbank & Luedke; 1964)



Per the geologic map, there is considerable variation in the local orientations of the fissures, faults, and veins in the vicinity of the Red and Bonita Mine and this was apparent within the tunnel with various sections of the tunnel demonstrating prominent jointing and others exhibiting random jointing. Due to the considerable variation in jointing, no discontinuity measurements were taken during the site visit.



Photos 1 & 2: Contrast in Rock Jointing and Tunnel Section
(Well defined jointing and rectangular profile (left) vs. numerous random jointing and rounded profile (right))

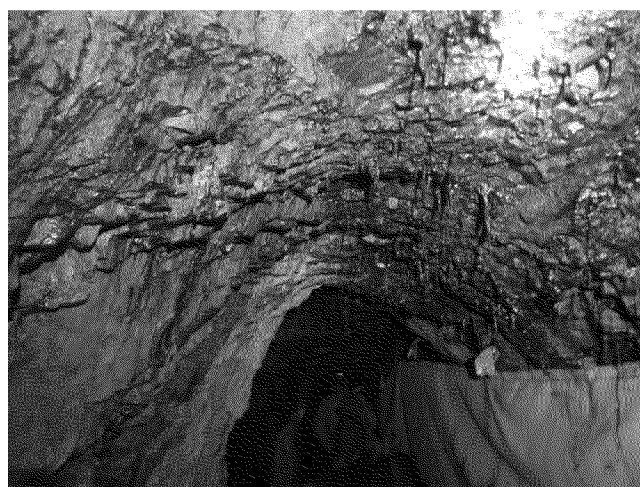
The portal area has been supported by a corrugated metal pipe, overhead timber lagging, and dual timber square sets (one large and one small) within the past few years. Inby from the portal, the rock consists of a breccia, basically a conglomerate comprised of angular rock fragments in a cemented matrix, for the first 40 to 60 feet. Although the matrix material appears to be weathered, limited probing and hammer impacts indicate that the breccia is well cemented. The majority of the rock surfaces were stained and no recent or visible rock falls were apparent in the breccia.



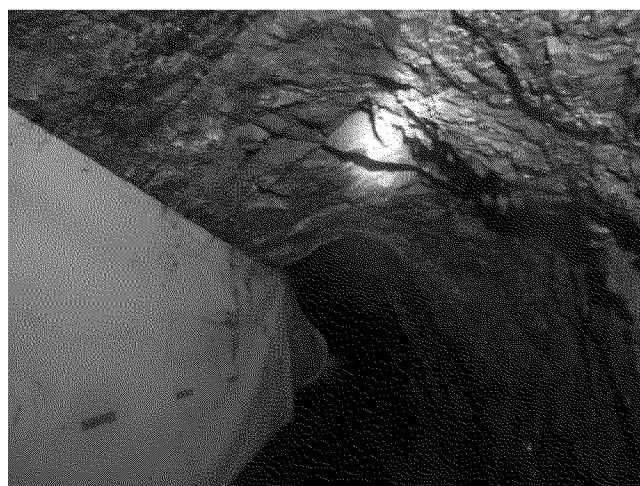
Photos 3 & 4: Initial Main Drift in Breccia near Portal



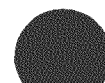
Beyond the breccia, the host rock switches to a relatively massive, homogenous volcanic rock (likely rhyodacite) with prominent vertical and near horizontal fracturing (refer to Photo 1). Further inby, the rock jointing varies significantly with other areas having frequent and randomly oriented joints without any apparent dominant joint sets (refer to Photo 2). The well-defined jointed areas and the “confused” jointed areas tend to alternate throughout the mine adits, as well as the frequency of jointing. Many of the joints appeared to be either tight or have some infilling and only infrequently were open fractures observed in the rock. While the 275-Drift was not entered during the site visit, a visual observation of the adit from the junction of the main drift indicated that rock conditions appeared similar to main drift and no stability issues were noted. For the main drift, there are several areas in the crown where the rock has been recently exposed; one of these was due to a surface boring penetrating the adit and several others were likely due to recent rock scaling operations for the DRMS inspections and vent line installation. Sporadic individual rock fragments (less than 3”) and small rock blocks (typical 3” thick by 12” square) showed some minor separation and it is recommended that a rock scaling program be implemented to reduce the rock fall hazards during construction. DRMS indicated that some of the rock blocks showing separation are still locked in place and will require significant effort to dislodge. Due to the infrequency of open fractures, only a minor amount of rock scaling will need to be performed. All of the unsupported adit areas visited appeared to be stable during the visit and would classify as “stable rock” per OSHA 1926.652 (a)(1)(i).



Photos 5 & 6: Typical Main Drift Rock Conditions



Photos 7 & 8: Typical Main Drift Rock Conditions



As an independent check of the self-supporting capabilities of the rock, the NGI Tunnel Quality Index rock mass classification system (Q-system) was utilized to assess the rock support requirements for the typical adit assuming pessimistic rock conditions. Per the attached Q-system evaluation, the small adit dimensions do not require any supplemental support for the worst rock conditions observed. The majority of the drift has rock conditions better than utilized for the evaluation, indicating even more stability. This confirms the field observations of adequate unsupported adit stability during the site visit.

In addition to the recent timber support at the portal, there were three areas that showed evidence of timber support. The first area was at the junction of the 275-Drift with the main adit where several round vertical posts are located adjacent to the junction; only one of these posts was blocked to the overlying rock (275-Drift) with the others in the main drift simply remnants of prior support. No evidence/debris of prior extensive timber support (such as timber sets or lagging) was observed in the invert. There does appear to be fresh rock surface overlying the junction and it is unknown as to whether this area was recently scaled. Regardless, the current rock conditions appeared to be stable and competent and do not appear to require supplemental support.



Photos 9 & 10: Junction of 275-Drift with Main Drift (Looking down 275-Drift with blocked timber post (left) and main drift looking outby with overhead fresh rock exposure and remnant posts (right))

At the junction of the Main Drift with the Northern Heading, a single round timber stull is located in the crown and supports several lagging boards while a second unloaded/unlagged timber stull is located inby. Limited probing of the stull and lagging with a geologist hammer indicates that the point is readily able to penetrate the outer 1/8" to 1/4" into the timber before relatively solid timber is reached. The timber support system appeared intact and no obvious signs of either distress or decay were observed. There appears to be less than 6" of rock debris loading the lagging and thus, for the heavy timber stull and lagging, the timber system is very lightly loaded. Based on the unsupported and exposed rock conditions surrounding the timber lagged area, consideration could be given to removing the timber supports and scaling the crown, however this presents some inherent rockfall risk and it is believed that leaving the timber in place and undisturbed is the best alternative given the current stability of the timber support and limited amount of construction access that is needed beyond the bulkhead and cofferdam area.





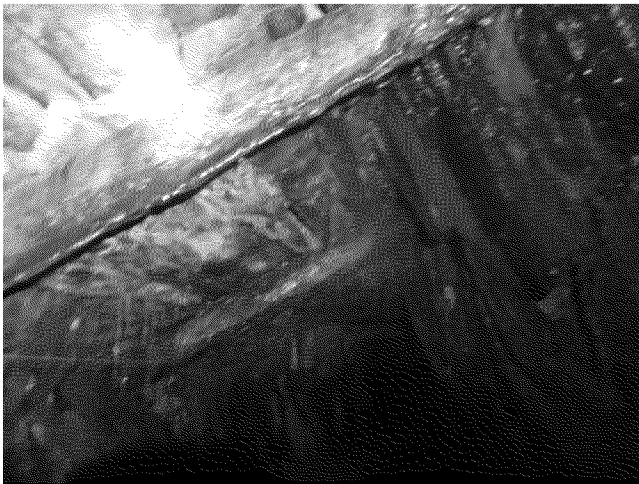
Photos 11 & 12: Isolated Stull and Lagging Support within Northern Drift near Junction of Main Adit Drift (looking inby with second stull visible in distance (left) and looking outby (right))

A more extensive timber lagged section exists further inby on the Northern Drift beyond an open stoped area where the adit appears to be following a mineralized vein. This area consists of a single post blocked to the rock followed by numerous sets of partial timber rib sets with overhead lagging and side lagging, timber stulls and lagging, followed by partial timber rib sets and crown lagging. The partial timber rib sets consists of a round timber post supporting a round horizontal beam which is keyed, wedged, or resting upon the inclined side wall; posts are on the left inby rib on the downstation end and on the right inby rib on the upstation end. Examination of the overhead conditions near the upstation end indicates a stoped area of approximately 6 feet above the timber lagging and approximately 1 vertical foot of rock debris loading the lagging. Similar to the other stulled section, probing with the point of the geologic hammer revealed that the interior of main timbers are solid with approximately 1/4" of penetration. The timber support system appears to be intact with no missing main members. The timber lagging overall appears to be in place with the most distressed lagging occurring in the sidewall on the downstation end of the supports. None of the main support members appeared stressed or overloaded and the overall system appears to be stable. The combination of the limited construction activities intended for the Northern Drift, the current stability of the timber system, and the limited rock loads acting on the timber system indicates that the probability failure during construction will be low. Although currently stable, it is recommended that a common sense approach be adopted during construction that avoids disturbing the existing timber supports and minimizes both the number of personnel and the duration that personnel will be below the timber supported areas.





**Photos 13 & 14: Partial Timber Rib Sets and Lagging in Northern Drift
(looking outby)**



Photos 15 & 16: Stull and Lagging Support (left) and Partial Rib Supports (right) within Northern Drift

Note that the termination of the injection pipe will require bolting the pipe to the rib of the adit above the invert sludge near the junction with the 764 Drift. This work will be performed within an area of stable competent rock which is currently self-supporting.

At the bulkhead location, Schmidt rebound hammer readings were taken in an attempt to assess rock strength. The hammer readings collected showed a wide variation in values and a subsequent review of unconfined compressive strength results for other bulkheads in the Burns Formation indicates intact compressive strengths in excess of 22 ksi. Per *ASTM D5873: Determination of Rock Hardness by Rebound Hammer Method* the upper limit of applicable test results is for 100 MPa (or 14.5 ksi) compressive strength rock; therefore, the Burns Formation exceeds the strength range appropriate for the rebound hammer tests and the hammer readings have not been processed or presented herein.



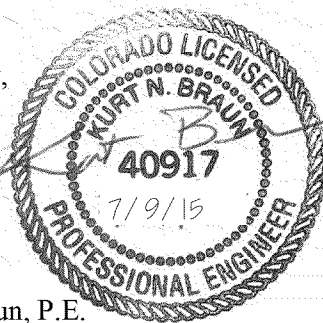
Conclusions:

Given that the mine was abandoned prior to 1901 and other than the portal area, the drift openings have remained open, unsupported, with no evidence of major rock instability, it is concluded that the rock possesses adequate self-supporting capabilities and classifies as “stable rock” per OSHA 1926.652 (a)(1)(i). Rock scaling of the crown and upper ribs should be performed to proactively control rock fall hazards prior to and during construction; the current extent of rock scaling appears to minor.

The timber supported areas are located where construction activities will be limited and the timber supports do not appear to be heavily loaded and appear capable of maintaining the opening stability throughout the anticipated construction duration. As a precaution during construction, it is recommended that personnel avoid lingering below the timber supported areas or disturbing the existing timber members.

Please call if you have any questions.

Sincerely,



Kurt Braun, P.E.
Principal Engineer
L-7 Services LLC





Red and Bonita Mine
near Silverton, Colorado
Q-System Estimate
Typical Adit: Poor Rock Conditions

Computed: KB 7/7/2015

Sheet: 1 of 1

Rock Mass Classification by the NGI Tunneling Quality Method

References

Barton, N., Lien, R. and Lunde J. (1974) Engineering classification of rock masses for the design of tunnel support. Rock Mechanics, Vol. 6, No. 4, pp. 189-236.
Grimstad, E. & Barton N. (1993). Updating the Q-system for NMT. Proc. Int. Symp. on Sprayed Concrete for Underground Support, Fagernes (eds Kompen, Opsahl & Berg), Oslo, Norwegian Concrete Association

Input Data:

		Rating	Explanation
Deere's Rock Quality Designation	RQD	50	Estimated based on heavily jointed areas
Joint set number	J _n	15	Four or more joint sets
Joint roughness number	J _r	1	Smooth, planar
Joint alteration number			
a. If rock walls are in contact	J _a	1	Unaltered joint walls; surface staining only
b. If contact within 10 cm shear	J _a		
c. If no rock wall contact when sheared	J _a		
Joint water reduction factor	J _w	0.66	Medium groundwater infiltration
Stress reduction factor			
a. Weakness zones, low stress	SRF	5	Shallow single shear zone with clay
b. Rock stress problems	SRF		
c. Squeezing/swelling rock	SRF		
Excavation span (m)	S	1.52	5 ft wide nominal adit width
Excavation support ratio	ESR	1.6	Permanent mine openings

Calculated Parameters

Block Size (=RQD/J _n)		3.333
Inter-block strength (= J _r /J _a)		1.000
Active Stress (= J _w /SRF)		0.132
Tunnelling Quality Index	Q	0.440
Equivalent Dimension	D _e	1

Legend

- | | |
|---|---|
| (1) Unsupported | (6) 90-120mm FRS + bolting |
| (2) Spot bolting | (7) 120-150mm FRS + bolting |
| (3) Systematic bolting | (8) >150mm FRS + reinforced ribs of shotcrete + bolting |
| (4) Systematic bolting w/ 40-100mm unreinforced shotcrete | (9) Cast concrete lining |
| (5) 50-90mm FRS + bolting | |

